



Primary Standards Laboratory Metrology Program

Fact Sheet

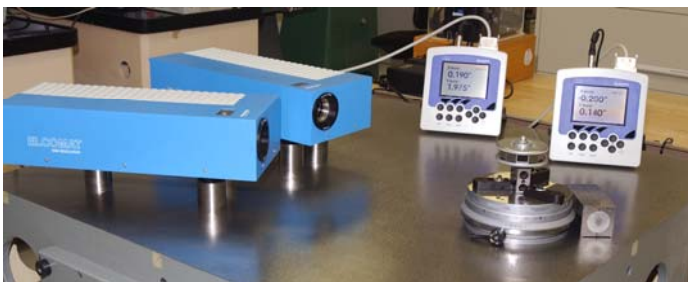
Primary Dimensional Standards



3D artifact measurements are performed using a Moore M-48 Universal Coordinate Measuring Machine (UCMM) retrofitted with Leitz controllers and optical system and QUINDOS software. The UCMM can measure in a 1.2 m x 0.8 m x 0.5 m volume with a resolution of 0.01 μm .

The Primary Standards Laboratory (PSL) maintains a wide variety of primary dimensional standards to assure accurate and traceable measurements for its customers.

Sub-micrometer capabilities include gage blocks, roundness, thread wires, gaging balls, surface roughness, step gages, line standards, and three-dimensional measurements (see below). All primary dimensional standards are directly traceable to the National Institute of Standards and Technology (NIST), other National Metrology Institutes, or to the wavelength of light. Most of the measurements listed here are accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) administered by NIST.



gage blocks are measured by comparison to reference blocks calibrated by NIST.

Customer short gage blocks (up to 4" or 100 mm)

are measured by comparison to reference blocks using a redundant drift-eliminating design. We measure our reference blocks against the wavelength of light on a Brown & Sharpe automated 2-color laser-based gage block interferometer. Customer long



Gage blocks, angle blocks, thread wires, gaging balls, index tables, optical polygons and squares, true squares, step gages, plain ring gages, optical flats, roundness, and surface roughness can be certified.



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laboratory

Dimensional Capabilities (95% confidence)

Length

UCMM-(1D)	$\pm(0.3 \mu\text{m} + 0.5 \text{ ppm})$
UCMM-(2D)	$\pm(0.5 \mu\text{m} + 0.6 \text{ ppm})$
UCMM-(3D)	$\pm(1 \mu\text{m} + 3 \text{ ppm})$
Short gage blocks	$\pm(37 \text{ nm} + 0.6 \text{ ppm})$
Long gage blocks	$\pm(127 \text{ nm} + 0.3 \text{ ppm})$

Flatness

Optical flats	$\pm 30 \text{ nm}$
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Surface Texture

Step standards	$\pm 0.0025\text{--}0.2 \mu\text{m}$
0.0125-12.5 μm	
Roughness standards	$\pm 0.0025\text{--}.07 \mu\text{m}$
0.0125-3.1 μm RA	

Angle

Angle gage blocks	$\pm 0.47'' \text{ arc}$
Optical squares	$\pm 0.46'' \text{ arc}$
True squares	$\pm 0.28'' \text{ arc}$
Index tables and	$\pm 0.08'' \text{ arc}$
Optical polygons (stack method)	

Roundness

Roundness stds.	$\pm(10.6 \text{ nm} + 6.8\%)$
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Diameter

Thread wires	$\pm 0.16 \mu\text{m}$
Gaging balls	$\pm 0.15 \mu\text{m}$
Plain plug gages and ring gages	$\pm(0.23 \mu\text{m} + 1.7 \text{ ppm})$

Major Resources

- State-of-the-art laboratory environmental controls
- Moore M48 Universal Coordinate Measuring Machine with optical subsystem
- Talyrond 73HPR high-precision roundness measuring system
- Brown & Sharpe automated 2-color laser gage-block interferometer
- Elcomat HR autocollimators
- Federal 4" and 24" gage block comparators
- Laser-augmented SIP MI-6B micro-indicator
- Talysurf 6 automated surface roughness measuring system
- Talystep film thickness measuring system
- Hewlett Packard Metrology Lasers
- Zeiss interference microscope

Selected Accomplishments

- NIST/NVLAP (National Voluntary Laboratory Accreditation Program) accreditation for most measurement parameters
- Successful participation in national and international round robins

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